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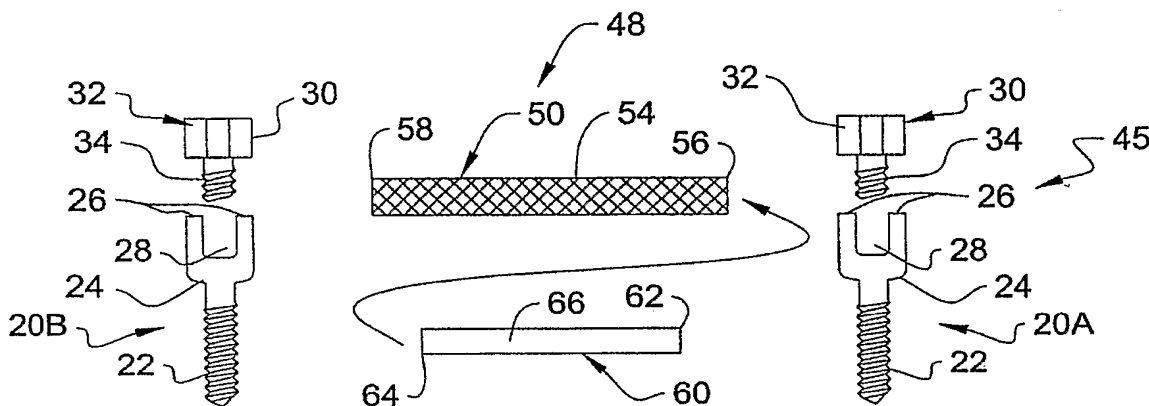
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[Continued on next page]

(54) Title: SYSTEMS AND METHODS FOR FLEXIBLE SPINAL STABILIZATION



(57) Abstract: Devices, methods and systems for stabilizing at least a portion of the spinal column are provided. Anchors are engageable to vertebra and a stabilization member is engageable between the anchors. The stabilization member includes an elongate tension member and a compression member in a passage of the tension member.

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## SYSTEMS AND METHODS FOR FLEXIBLE SPINAL STABILIZATION

### BACKGROUND

The spine is subject to various pathologies that compromise its load bearing and support capabilities. Such pathologies of the spine include, for example, degenerative diseases, the effects of tumors and, of course, fractures and dislocations attributable to physical trauma. In the treatment of diseases, malformations or injuries affecting spinal motion segments (which include two or more adjacent vertebrae and the disc tissue or disc space therebetween), and especially those affecting disc tissue, it has long been known to remove some or all of a degenerated, ruptured or otherwise failing disc. It is also known that artificial discs, fusion implants, or other interbody devices can be placed into the disc space after disc material removal. External stabilization of spinal segments alone or in combination with interbody devices also provides advantages. Elongated rigid plates, rods and other external stabilization devices have been helpful in the stabilization and fixation of a spinal motion segment.

### BRIEF DESCRIPTION OF THE FIGURES

Fig. 1 is an exploded view of a stabilization system.

Fig. 2 is an end view of a tension member of the stabilization system of Fig. 1.

Fig. 3 is an end view of the tension member of Fig. 2 with a compression member in a passage thereof to form a stabilization member.

Fig. 4 is an elevation view showing attachment of the stabilization system to vertebrae of the spinal column.

Fig. 5 is an elevation view showing the stabilization system attached to multiple vertebral levels.

Fig. 6 is a section view of the stabilization system.

Fig. 7 is a section view of another embodiment stabilization system.

Fig. 8 is a section view of another embodiment stabilization system.

Fig. 9 is a section view of another embodiment stabilization member.

Fig. 10 is a section view showing the stabilization member of Fig. 9 engaged to vertebrae of a spinal column.

Fig. 11 is a section view of another embodiment stabilization member.

Fig. 12 is a section view of another embodiment stabilization member.

Fig. 13 is a section view of another embodiment stabilization member.

Fig. 14 is an elevation view of another embodiment stabilization member.

Fig. 15 is an elevation view of the stabilization member of Fig. 14 subjected to a compression load.

Fig. 16 is a perspective view of the stabilization member of Fig. 15.

#### DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

For the purposes of promoting an understanding of the principles of the invention, reference will now be made to the embodiments illustrated in the drawings and specific language will be used to describe the same. It will nevertheless be understood that no limitation of the scope of the invention is hereby intended. Any such alterations and further modifications in the illustrated devices, and any such further applications of the principles of the invention as illustrated herein are contemplated as would normally occur to one skilled in the art to which the invention relates.

Fig. 1 depicts a spinal stabilization system 45 according to one embodiment for stabilizing at least a portion of the vertebral column. Stabilization system 45 includes a first anchor 20A and a second anchor 20B engageable to bony portions of the spinal column. A stabilization member 48 is positionable between anchors 20A and 20B and engageable to anchors 20A and 20B to provide a stabilization effect to the spinal column.

Stabilization member 48 includes a tension member 50 and at least one compression member 60. Tension member 50 includes a body 54 having a passage 52 extending between opposite ends 56, 58 of body 54. Compression member 60 includes a body 66 extending between ends 62, 64 thereof. Compression member 60 is positionable in passage 52 of tension member 50 to form stabilization member 48. Stabilization system 45 allows at least small degrees of spinal motion in the spinal motion segment to which it is attached since stabilization member 48 is at least partially flexible between adjacent anchors 20A and 20B. When engaged to anchors 20A, 20B, tension member 50 resists movement of the vertebrae away from one another and compression member 60 resists movement of the vertebrae toward one another.

Fig. 1 shows one embodiment of anchor 20 in the form of a uni-axial bone screw. Anchor 20 includes a threaded bone engaging portion 22 and a receiver member 24. Receiver member 24 includes a passage 28 for receiving stabilization member 48 between

arms 26 of receiver member 24. A plug 30 is attachable to receiver member 24 to secure stabilization member 48 relative to anchor 20. In the illustrated embodiment, plug 30 includes a set screw portion 34 engageable to internal threads provided along arms 26, and a head portion 32 engageable by a driving tool.

Other embodiments contemplate other forms for anchor 20. For example, the bone engaging portion can be a hook, staple, rivet, expansion anchor, or other suitable device for engaging bony structure. The receiver member can be U-shaped for top-loading of the stabilization member 48 as shown. Other embodiments include side-loading or bottom loading receiver members. The receiver member can include any suitable form for engagement with stabilization member 48. Receiver member 24 can also be rotatably mounted on bone engaging portion 22 to provide multi-axial capabilities. Plug 30 can be configured for engagement around receiver member 24. Plug 30 can be engaged with receiver member 24 by means other than threaded engagement, including interference fits, snap fits or bayonet locks, or auxiliary fixation elements such as sutures, pins, or adhesives, for example.

Stabilization system 45 can be employed in the treatment of various spinal conditions, such as spinal stenosis, scoliosis, degenerative disc disease, disc herniation, and vertebral fractures, for example. Stabilization system 45 can also be employed in combination with various treatment systems, including providing supplemental instrumentation for procedures that include the placement of spinal fusion devices, artificial disc devices, nucleus replacement devices, and procedures which remove disc and bone material, such as discectomy procedures, nucleotomy procedures, laminectomy procedures, and facetectomy procedures, for example. Stabilization system 45 provides compression load sharing and intervertebral space distraction at the treated spinal levels while allowing limited motion of the spinal motion segments due to the flexibility of the tension member and compression member components of the system. For example, depending on the attachment location of system 45, excessive load on degenerated disc and facet joints can be reduced or eliminated through the compression load sharing capabilities provided by compression member 60. The disc space and facet joints can also be distracted with compression member 60 maintaining the distraction to provide a desired spacing between the bone on opposite sides of the effected joints.

Stabilization system 45 may include a single or multi-level composite stabilization member 48 and anchors to engage the stabilization member to two or more vertebrae. In one embodiment, stabilization member 48 includes tension member 50 in the form of a flexible outer sheath that resists tension when engaged to the anchors, and compression member 60 is housed within the outer sheath to resist compression between the anchors when tension member 50 is engaged to the anchors. Stabilization member 48 can be anchored to posterior elements of the vertebrae of the spinal column using anchors 20A, 20B or any other suitable anchoring device. Stabilization member 48 can also be secured along the anterior portions of the vertebrae of the spinal column using anchors 20A, 20B or any other suitable anchors. Multiple stabilization members 48 can be secured along the same one or same multiple vertebral levels. It is also contemplated that multiple stabilization members 48 can be secured along different vertebral levels along the spinal column. The same stabilization member 48 can also be adapted to extend along multiple vertebral levels of the spinal column.

When stabilization system 45 is engaged to the spinal column, the treated levels of the spinal column are partially unloaded by compression member 60. Excessive extension of the vertebral level or levels is resisted by compression member 60, and excessive flexion of the treated vertebral level or levels is resisted by the flexible outer sheath of tension member 50. The tension and compression members 50, 60 act together to resist excessive lateral bending and axial rotation of the one or more vertebral levels that are being treated.

In Fig. 4 there is shown a first vertebra 36 and a second vertebra 40 positioned on opposite sides of a disc space 38. First anchor 20A is engaged to first vertebra 36, and second anchor 20B is engaged to second vertebra 40. With compression member 60 removed, tension member 50 includes a collapsible structure as shown in Fig. 2. Second end 58 of tension member 50 is positioned in the receiver member of second anchor 20B. Plug 30 is engaged to second anchor 20B to secure second end 58 therein. Since tension member 50 is collapsible, second end 58 is crimped between the lower surface of receiver member 24 and plug 30 when secured in anchor 20B.

Compression member 60 can then be loaded through the opening of tension member 50 adjacent first end 56. Compression member 60 occupies passage 52 so that tension member 50 conforms to the outer shape of compression member 60, as shown in Fig. 3.

Compression member 60 has a length between ends 62, 64 sized to extend between and abut the sides of anchors 20A and 20B oriented toward one another. In one embodiment, compression member 60 can be compressed between its outer ends and positioned between anchors 20A, 20B and then released to expand against anchors 20A, 20B to distract the space between anchors 20A, 20B.

Tension member 50 is positioned in passage 28 of receiver 24 of first anchor 20A and secured therein. Plug 30 of first anchor 20A is engaged thereto to crimp or collapse tension member 50 between the bottom surface of first anchor 20A and plug 30.

Compression member 60 extends between and abuts the anchors 20A, 20B to function as a shock absorber while allowing limited movement of anchors 20A, 20B toward one another upon movement of vertebrae 36, 40. If necessary or desirable, the portion of tension member 50 extending through first anchor 20A away from second anchor 20B can then be severed to minimize the length of the tension member 50 extending from first anchor 20A.

As shown in Fig. 6, when tension member 50 is engaged to anchors 20A, 20B, first and second ends 56, 58 are crimped in the respective anchor 20A, 20B between bottom surfaces of the receiver members and the plug engaged to the anchor. The crimping of ends 56, 58 collapses passage 52 of tension member 50 in receiver 24 of anchors 20A, 20B. The flexibility of tension member 50 allows passage 52 to be contoured from this crimped configuration to a shape that is restored upon positioning of compression member 60 in passage 52.

In a further embodiment, a third anchor 20C can be engaged to a third vertebra 44 on the other side of disc space 42, as shown in Fig. 5. A second compression member 60B is positioned in the portion of passage 52 of tension member 50 extending from first anchor 20A. The end of tension member 50 is positioned in passage 28 of third anchor 20C and secured therein with a plug. Second compression member 60B extends between anchors 20A and 20C, and functions as a shock absorber to resist movement of anchors 20A, 20C and thus vertebrae 36, 44 toward one another.

In Fig. 7, stabilization system 45 includes stabilization member 48 engaged to first and second anchors 20A and 20B. Stabilization member 48 includes a compression member 60 having rigid portions 70A, 70B at opposite ends of an intermediate compressible body 66. Rigid portions 70A, 70B provide a more rigid interface between tension member 50 and the respective anchor 20A, 20B than is provided by engaging

tension member 50 between the anchor and plug as shown in Fig. 6. Rigid portion 70A includes an enlarged end portion 72 positionable adjacent the respective end of intermediate compressible body 66, and a stem 74 extending from end portion 72 and through the receiver member 24 of the respective anchor 20A, 20B. In the illustrated embodiment, rigid portions 70A, 70B are T-shaped. Other shapes are also contemplated, including funnel shapes and mushroom shapes for example.

Plugs 30 are engageable to the respective anchor 20A, 20B to clamp the stem 74 between the plug and the anchor seat. Rigid portions 70A, 70B can be more rigid than compressible body 66, providing a rigid platform extending from anchors 20A, 20B against which the ends of the intermediate compressible body 66 bear in resisting compression loading. The rigid stem 74 may also provide greater resistance to slippage of tension member 50 in anchors 20A, 20B since tension member 50 is not collapsed upon itself, but rather engages stem 74 when engaged in anchors 20A, 20B. End portions 72 are enlarged and sized to mate with the ends of the intermediate compressible body 66 of compression member 60 to distribute the compression load thereto.

In Fig. 8 stabilization system 45 includes washers 78A, 78B at opposite ends of tension member 50 adjacent the respective anchor 20A, 20B. Washers 78A, 78B include a central aperture extending therethrough through which tension member 50 and the respective stem 74 of rigid portions 70A, 70B are received. Washers 78A, 78B abut the respective adjacent end portion 72 of rigid portion 70A, 70B, with tension member 50 extending therebetween. Washers 78A, 78B provide a platform against which the adjacent receiver 24 of anchors 20A, 20B can be positioned to distribute compression loading through the adjacent rigid portion 70A, 70B to compression member 60.

In another embodiment, washers 78A, 78B are employed in system 45 without rigid portions 70A, 70B. In this embodiment, washers 78A, 78B abut the ends of body 66 of compression member 60 with tension member 50 extending therebetween. In another embodiment, multiple washers are employed at one or both ends of tension member 50 to occupy the space between the adjacent receiver 24 of anchors 20A, 20B and either the compression member 60 or rigid portion 70A, 70B. In this embodiment, the washers allow the compression member to be positioned in contact with the anchors 20A, 20B through the washers 78 even though the length of compression member 60 may not be sufficient to extend the entire distance between the anchors.



Fig. 9 shows another embodiment stabilization member 148 which includes tension member 50 and a compression member 160. Compression member 160 includes a plurality of alternately positioned rigid portions 164 and compressible portions 162. As shown in Fig. 10, stabilization member 148 is engaged to vertebrae 36, 40 with anchors 20A, 20B. The rigid portions 164 are aligned with the receivers 24 of the anchors 20A, 20B and engaged thereto with the plug. One or more intermediate rigid portions 164 are positioned between compressible portions 162.

In Fig. 9 compressible portions 162 and rigid portions 164 are cylindrical in shape and are positioned in tension member 50 to abut one another in end-to-end fashion. Other shapes for alternating rigid and compressible portions are also contemplated. For example, in Fig. 11 rigid portions 164 each include a receptacle 165 oriented toward the other rigid portion 164. Compressible portion 162 includes opposite extensions 163 that are received in adjacent ones of the receptacles 165. In the illustrated embodiment, the receptacles 165 are concavely curved and the extensions 163 are convexly curved to eliminate sharp and abrupt corners in the interface between extensions 163 and receptacles 165. The concave-convex interface provides stability to compression member 160 to resist lateral or axial slipping of the portions of the compression member 160 relative to one another. Other axial interfaces are also contemplated, including telescoping components and other interdigitating arrangements between the rigid and compressible portions. In another embodiment, an elongated member, such as a suture or strand, extends through aligned central apertures of portions 162, 164. The elongated member is engaged at opposite ends of compression member 160 to maintain the adjacent rigid and compressible portions in alignment with one another and in axial position relative to one another.

Referring to Fig. 12, there is shown another embodiment compression member 260 positioned in passage 52 of tension member 50. Compression member 260 includes a number of compression elements 261 that each includes a central compressible portion 266. Compression elements 261 further include upper and lower rigid portions 262 positioned on opposite sides of compressible portion 266. Rigid portions 262, 264 are separated by a gap 268 which allows rigid portions 262, 264 to moved toward one another in response to compression of compressible portion 266. A series of compression

elements 261 can be placed one adjacent the other along passage 52 with the adjacent rigid portions abutting one another in end-to-end fashion.

In the illustrated embodiment, rigid portions 262, 264 include concavely curved recesses oriented toward one another that receive compressible portion 266 therebetween. Rigid portions 262, 264 extend axially along at least a portion of compressible portion 266 to laterally and axially constrain compressible portion 266 therebetween. Compressible portion 266 includes a rounded or spherical shape to provided a uniform transition of compressive forces between adjacent ones of the compression elements 261.

Referring now to Fig. 13, there is shown another embodiment stabilization member 345 which includes tension member 50 and compression member 360 in passage 52 of tension member 50. Compression member 360 includes a compressible portion 362 and rigid portions 364. The intermediate rigid portion 364 includes a dumbbell type shape with enlarged end portions 366 and a stem 368 extending between enlarged end portions 366. Rigid portions 364 contact the adjacent end of an adjacent compressible portion 362. In the illustrated embodiment, the rigid portions 364 at the ends of compression member 360 include only a single enlarged end portion 366, and a stem 368 extending therefrom to a free end.

Stabilization member 345 further includes a rigid sleeve 370 positioned about stem 368 and tension member 50 along the intermediate rigid portion 364. Sleeve 370 includes opposite enlarged ends 372 and a sleeve portion 374 extending between ends 372. Enlarged ends 372 extend radially outwardly about sleeve portion 374, and contact an adjacent one of end portions 366 of rigid portion 354 with tension member 50 extending therebetween. At the opposite ends of compression member 360, there are provided rigid sleeves 370 that include only a single enlarged end 372 at one end of a rigid sleeve portion 374.

The rigid sleeves 370 provide fixation locations along stabilization member 345 for engagement of anchors 20A, 20B to stabilization member 345. Sleeves 370 are positioned with sleeve portion 374 in passage 28 of the respective anchor with enlarged ends 372 in contact with arms 26 of the anchor. Enlarged ends 372 axially constrain sleeve 370 in the respective anchor. Enlarged ends 372 also abut enlarged end portions 366 with tension member 50 therebetween to axially constrain compression member 360 between the anchors. Furthermore, sleeve portions 374 of sleeves 370 provide a barrier between

tension member 50 and the plug and anchor to protect tension member 50 from cutting or tearing upon engagement of the plug with the anchor.

Referring to Figs. 14-16, another embodiment stabilization member 448 is shown. Stabilization member 448 includes an intermediate portion having a tension member 50 and a compression member 460 positioned in tension member 50. Tension member 50 is comprised of a flexible outer sleeve having a passage for receiving compression member 460. Rigid portions 470 are engaged to and extend from opposite ends of tension member 50 and compression member 460. Rigid portions 470 include an enlarged end portion 472 adjacent to and in abutting engagement with the ends of tension member 50 and compression member 460. A stem 474 extends from enlarged end portion 472 and away from tension member 50 and compression member 460. Stem 474 is positionable in the passage of a receiver of an anchor, and engageable in the anchor with plug to secure stabilization member to respective ones of adjacent vertebrae.

Tension member 50 is flexible and restrains movement of the anchors away from one another. Movement of the anchors toward one another is restrained by compression member 460, which can bulge outwardly in tension member 50 when a compression load is applied to the ends thereof through rigid portions 470, as shown in Figs. 15 and 16. Accordingly, stabilization member 448 allows limited motion of the spinal motion segment while providing flexible restraint in flexion, extension and rotation. As the intermediate portion is subjected to loading of the spinal column, rigid portions 470 are moveable relative to one another in response to tensioning of compression of tension member 50 and/or compression member 460.

Various modes of attachment of rigid portions 470 with tension member 50 and/or compression member 460 are contemplated. In the illustrated embodiment, enlarged end portions 472 include a plurality of holes 478 that receive threads 479 extending through tension member 50 and/or compression member 460. Other embodiments contemplate rigid portions 470 are attached by fasteners, molding, fusing, gluing or otherwise securing rigid portions to tension member 50 and/or compression member 460.

In one embodiment, stabilization member 448 is adapted for engagement with a percutaneous insertion instrument, such as is disclosed in U.S. Patent No. 6,530,929 and U.S. Patent Application Serial No. 10/769,569, each of which is incorporated herein by reference. One of the rigid portions 470 includes a tapered leading end 477 to facilitate

percutaneous placement, and the other rigid portion 470 includes a recess 471 to facilitate engagement with the insertion instrument in a predetermined orientation.

Tension member 50 can be made from any suitable material, including polymers, metals, or ceramics, for example. Examples of suitable polymers include elastomers, plastics, rubber and any polymer capable of being processed into high performance synthetic fibers. Examples of suitable synthetic fibers include polyethylene, polyesters, polyvinyl alcohol, polyaryletherketone, polyurethane, copolymer of silicone and polyurethane. Tension member 50 can be made from any copolymer, blend, composite or laminate of synthetic fiber material. Examples of copolymers suitable for synthetic fiber material include silicone-polyurethane copolymers. Examples of blends for synthetic fiber material include silicone with polyurethane. Examples of composites of synthetic fiber material include polyester mesh or fiber within polyurethane. Examples of laminates for synthetic fiber material include braided polyester tubing and silicone polyurethane copolymers. In one embodiment, tension member 50 is formed by braided synthetic fibers woven into a tube.

Tension member 50 can be provided in any length ranging from 0.5 cm or less to 100 cm or more. In one embodiment, the length is sized to extend through adjacent anchors engaged to vertebrae on each side of a vertebral level. Tension member 50 can include any cross-sectional shape, including round, oval, rectangular, square, hexagonal or any other suitable shape for receiving the compression member therein. Tension member 50 can be made by braiding, weaving, knitting, sewing, extrusion, injection molding, compression molding, casting, bonding or laminating, for example.

The compression members can be made from any suitable material, including polymers, metals, or ceramics. Examples of suitable polymers include elastomers, plastics and rubber. Examples of suitable elastic or rubbery polymers include silicone, polyurethane, copolymer of silicone and polyurethane, polyolefin, and hydrogels. The compression members can be made from any copolymer, blend, composite or laminate of the polymer materials. Examples of copolymers include silicone-polyurethane copolymers. Examples of blends include silicone with polyurethane. Examples of composites include polyester mesh or fiber within polyurethane. Examples of laminates include multiple layers of polyester mesh and silicone polyurethane copolymers.

The compression members can be provided in any length ranging from 0.5 cm and less to 100 cm or more. In one embodiment, the length is sized to extend between adjacent anchors engaged to vertebrae on each side of a vertebral level. In another embodiment, the compression member is provided with compressible portions and rigid portions and/or washers as discussed above that allow the length of the compression member to be adjusted by adding or removing the compressible portions, rigid portions, and/or washers from compression member 60. The compression member can include any cross-sectional shape, including round, oval, rectangular, square, hexagonal or any other suitable shape. The surfaces of the compression member can include features on or under the surface that provide a desired modification to material behavior. Such features include grooves, holes, voids, cavities, extensions, receptacles, or other features that can modify stiffness, compliance, shock absorption, compression resistance, and/or engagement with an adjacent rigid portion, for example. The compression members can be made by any suitable process, including extrusion, injection molding, compression molding, casting, bonding, laminating or machining, for example.

In the illustrated embodiments, the compression members are removably received in tension member 50. It is also contemplated that tension member 50 and the compression member positioned therein can be physically bonded to one another. Tension member 50 can be molded in attachment with the compression member to form a unitary composite structure. The compression member can be comprised of one or more compressible portions alone or in combination with one or more rigid portions. The compressible and rigid portions can be separate components, can be formed as an integral member, or can be fastened to one another with adhesives, fusion or fasteners.

It is also contemplated that compression member can be provided with multiple sections having differing levels of stiffness or other physical characteristic to work in concert with one another in the stabilization system. Tension member 50 can be fastened to rigid portions of the compression member in the anchors. Alternatively, a rigid sleeve can be placed about tension member 50 with a rigid portion of the compression member extending through the outer sleeve as well. The rigid outer sleeve provides an attachment location along the stabilization member for engagement to the bone anchors.

It should be understood that the stabilization systems discussed herein may be utilized in all regions of the spine, including the cervical, thoracic, lumbar, lumbo- sacral

and sacral regions of the spine. It should also be understood that the stabilization systems may extend across a spinal motion segment having only two vertebrae or more than two vertebrae. It is further contemplated two or more stabilization systems may be employed simultaneously along the same spinal motion segment. Additionally, although the stabilization systems are suited for applications in a posterior region of the spinal motion segment or segments, the stabilization system may alternatively or additionally be applied in other surgical approaches and combinations of surgical approaches to the spinal motion segment, including anterior, antero-lateral, lateral, and/or postero-lateral portions of the spinal motion segment or segments.

While the invention has been illustrated and described in detail in the drawings and foregoing description, the same is to be considered as illustrative and not restrictive in character, it being understood that all changes and modifications that come within the spirit of the invention are desired to be protected.

What is claimed is:

1. A system for stabilizing a spinal motion segment, comprising:  
an elongate tension member sized to span a distance between at least two vertebral bodies, said elongate tension member including a flexible, tubular sleeve with an inner passage extending therethrough, said inner passage being collapsible along at least a portion of the length of said sleeve, said tension member being engageable to a pair of anchors engageable to respective ones of the at least two vertebrae, said tension member allowing limited displacement of said pair anchors away from one another when engaged thereto; and  
a compression member positionable in said passage of said elongate tension member, said compression member including a cross-section sized to at least partially restore said collapsible passage portion when positioned therein, said compression member including at least one compressible portion between said anchors and having a length between opposite ends thereof sized to extend between and contact said pair of anchors to allow limit displacement of said pair of anchors toward one another.
2. The system of claim 1, wherein a portion of said passage of said sleeve is crimped when engaged to one of said pair of anchors to completely collapse said portion of said passage in said anchor.
3. The system of claim 2, wherein each of said anchors includes a receiver having a passage for receiving said tension member and a plug engageable to said receiver to crimp said tension member in said receiver.
4. The system of claim 1, wherein said compression member is slidably received in said passage of said tension member.
5. The system of claim 1, wherein said compression member includes a pair of rigid portions at opposite ends of said compressible portion, said rigid portions extending in said passage of said tension member and being positioned for engagement with a corresponding one of said pair of anchors when said tension member is engaged thereto.

6. The system of claim 1, wherein said compression member includes a number of rigid portions separated from one another by a number of compressible portions between adjacent ones of said rigid portions, said rigid portions and said compressible portions being received in said passage of said tension member.

7. The system of claim 6, wherein at least one of said rigid portions is aligned with a respective one of said pair of anchors in said tension member, said at least one rigid portion being engaged to said respective anchor when said tension member is engaged to said respective anchor.

8. The system of claim 6, wherein said rigid portions and said compressible portions include a concave-convex interface.

9. The system of claim 6, wherein at least one of said compressible portions includes an axial extension at opposite ends thereof and at least one of said rigid portions includes an axial recess positionable toward said axial extension, said axial recess receiving said axial extension.

10. The system of claim 6, wherein said rigid portions and said compressible portions are each cylindrical and abut one another in end-to-end fashion in said tension member.

11. The system of claim 1, wherein said compression member includes a number of compression elements, each of said compression elements including opposite rigid portions defining a cavity therebetween and a compressible portion in said cavity extending between said rigid portions.

12. The system of claim 11, wherein said rigid portions define a gap therebetween at least when said compressible portion is not compressed.



13. The system of claim 1, wherein said compression member includes at least one rigid portion having a first enlarged end portion abutting a first end of a first compressible portion, said at least one rigid portion including a stem extending from said enlarged end portion through a receiver of an adjacent one of said pair of anchors.

14. The system of claim 13, wherein said at least one rigid portion further includes a second enlarged end portion at an end of said stem opposite said first enlarged end portion, said second end enlarged portion abutting an adjacent end of a second compressible portion on a side of said adjacent anchor opposite said first compressible portion.

15. The system of claim 14, further comprising a second rigid portion abutting a second end of said first compressible portion opposite said first end of said first compressible portion, said second rigid portion including an enlarged end portion abutting said second end of said compressible portion and a stem extending from said enlarged end portion through a receiver of the other of said pair of anchors.

16. The system of claim 14, further comprising a rigid sleeve extending about said tension member along said stem of said rigid portion, said sleeve being engageable in said receiver of said adjacent anchor.

17. The system of claim 16, wherein said sleeve includes enlarged ends extending radially about a sleeve portion extending between said enlarged ends, said enlarged ends of said sleeve abutting an adjacent one of said enlarged portions of said rigid portion with said tension member extending between said sleeve and said rigid portion.

18. The system of claim 1, wherein said sleeve of said tension member includes a braided tube formed with synthetic fibers.

19. The system of claim 18, wherein said synthetic fibers are made from a material selected from the group consisting of: copolymers; blends, composites; and laminates.

20. A system for stabilizing a spinal motion segment, comprising:  
an elongate tension member sized to span a distance between at least two vertebral bodies, said elongate tension member including a braided polymeric sleeve with an inner passage extending therethrough, said tension member being engageable to a pair of anchors engageable to respective ones of the at least two vertebrae, said tension member allowing limited displacement of said pair anchors away from one another when engaged thereto; and

a compression member positionable in said passage of said elongate tension member, said compression member including at least one compressible portion between said anchors and having a length between opposite ends thereof sized to extend between and contact said pair of anchors to allow limit displacement of said pair of anchors toward one another.

21. The system of claim 20, wherein said inner passage is collapsed along at least a portion of the length of said sleeve, said compression member including a cross-section sized to at least partially restore said collapsed passage portion when positioned therein.

22. The system of claim 21, wherein a portion of said passage of said sleeve is crimped when engaged to one of said pair of anchors to completely collapse said portion of said passage in said anchor.

23. The system of claim 22, wherein each of said anchors includes a receiver having a passage for receiving said tension member and a plug engageable to said receiver to crimp said tension member in said receiver.

24. The system of claim 20, wherein said compression member includes a number of rigid portions separated from one another by a number of compressible

portions between adjacent ones of said rigid portions, said rigid portions and said compressible portions being received in said passage of said tension member.

25. The system of claim 24, wherein at least one of said rigid portions is aligned with a respective one of said pair of anchors in said tension member, said at least one rigid portion being engaged to said respective anchor when said tension member is engaged to said respective anchor.

26. The system of claim 24 wherein at least one of said compressible portions includes an axial extension at opposite ends thereof and at least one of said rigid portions includes an axial recess positionable toward said axial extension, said axial recess receiving said axial extension.

27. The system of claim 24, wherein said rigid portions and said compressible portions are each cylindrical and abut one another in end-to-end fashion in said tension member.

28. The system of claim 20, wherein said compression member includes a number of compression elements, each of said compression elements including opposite rigid portions defining a cavity therebetween and with said compressible portion in said cavity.

29. The system of claim 28, wherein said rigid portions define a gap therebetween at least when said compressible portion is not compressed.

30. The system of claim 20, wherein said compression member includes at least one rigid portion having a first enlarged end portion abutting a first end of said compressible portion, said at least one rigid portion including a stem extending from said enlarged end portion through a receiver of an adjacent one of said pair of anchors.

31. The system of claim 30, further comprising a rigid washer positioned about said tension member between said adjacent anchor and said enlarged end portion of said rigid portion, said stem and said tension member extending through said washer.

32. The system of claim 30, further comprising a rigid sleeve extending about said tension member along said stem of said rigid portion, said sleeve being engageable in said receiver of said adjacent anchor.

33. A system for stabilizing a spinal motion segment, comprising:  
an elongate tension member sized to span a distance between at least two vertebral bodies, said elongate tension member including a flexible sleeve with an inner passage extending therethrough, said tension member extending through a receiver of at least one anchor engageable to a vertebra; and

a compression member positionable in said passage of said flexible sleeve, said compression member including at least one compressible portion and a rigid portion in contact with an end of said compressible portion, said rigid portion extending through a portion of said tension member in said receiver of said at least one anchor and said tension member and said rigid portion being engageable in said receiver with a plug engageable to said receiver of said at least one anchor.

34. The system of claim 33, wherein said compressible portion and said rigid portion of said compression member are cylindrical.

35. The system of claim 33, wherein said rigid portion includes an enlarged end portion in contact with said end of said compressible portion and a stem extending from said enlarged end portion through said portion of said tension member in said receiver.

36. The system of claim 35, wherein said rigid portion includes a second enlarged end portion at an end of said stem opposite said enlarged end portion.

37. The system of claim 36, further comprising a rigid sleeve positioned about said tension member and said stem, said sleeve being engageable in said receiver with said plug.

38. The system of claim 37, wherein said rigid sleeve includes a sleeve portion and enlarged ends extending radially about said sleeve portion, said enlarged ends of said sleeve abutting an adjacent one of said enlarged ends of said rigid portion with said tension member extending therebetween.

39. The system of claim 35, further comprising a washer positioned about said tension member between said receiver of said at least one anchor and said enlarged end portion of said rigid portion.

40. The system of claim 33, wherein said flexible sleeve is collapsible and said compressible portion includes a cross-section sized to prevent said sleeve from collapsing when positioned therein.

41. The system of claim 33, wherein said flexible sleeve is comprised of a tube formed by braided synthetic fibers.

42. A method for stabilizing the spinal column, comprising:  
engaging a first end of a flexible tension member to a first anchor engaged to a first vertebra;  
positioning a compression member in a passage of said tension member with a first end of said compression member adjacent the first anchor;  
positioning a second end of the compression member adjacent a second anchor engaged to a second vertebra with the second end of the compression member adjacent the second anchor; and  
engaging the tension member to the second anchor.

43. The method of claim 42, further comprising:  
positioning a second compression member in a passage of said tension member with a first end of said second compression member adjacent the second anchor;  
positioning a second end of the second compression member adjacent a third anchor engaged to a third vertebra with the second end of the second compression member adjacent the third anchor; and  
engaging the tension member to the third anchor.

44. The method of claim 42, wherein engaging the tension member to the second anchor includes crimping the tension member in a receiver member of the anchor.

45. The method of claim 42, wherein the passage of the tension member is collapsible and positioning the compression member in the passage restores the collapsed passage of the tension member.

46. The method of claim 42, wherein the tension member is a braided sleeve.

47. The method of claim 42, wherein positioning the compression member in the passage includes alternately positioning at least one rigid portion and at least one compressible portion in the passage of the tension member.

48. The method of claim 47, further comprising engaging a first one of the rigid portions with the tension member in the first anchor and a second one of the rigid portions with the tension member in the second anchor.

49. The method of claim 47, wherein positioning the compression member in the passage includes positioning a number of compression elements in the passage, the compression elements each including a pair of rigid portions and a compressible portion between said rigid portions.

50. A system for stabilizing a spinal motion segment, comprising:  
an intermediate portion including a tension member comprising a flexible sleeve  
and a compression member positioned in said flexible sleeve; and  
first and second rigid portions extending from opposite ends of said flexible  
tension member and said flexible compression member, said first and second rigid  
portions engageable to respective ones of first and second anchors engageable to  
respective ones of first and second vertebrae, said first and second rigid portions being  
movable relative to one another upon compression or extension of said intermediate  
portion.

51. The system of claim 50, wherein:  
said first and second rigid portions each include an enlarged end portion in  
abutting engagement with an adjacent end of said intermediate portion and an elongated  
stem extending from said enlarged end.

52. The system of claim 51, wherein at least one of said enlarged ends of  
said rigid portions includes a plurality of holes and further comprising at least one  
attachment member extending through said holes engaging said at least one enlarged  
end to said intermediate portion.

53. The system of claim 50, wherein said compression member bulges  
outwardly in said flexible sleeve in response to a compression load applied to said  
intermediate portion.

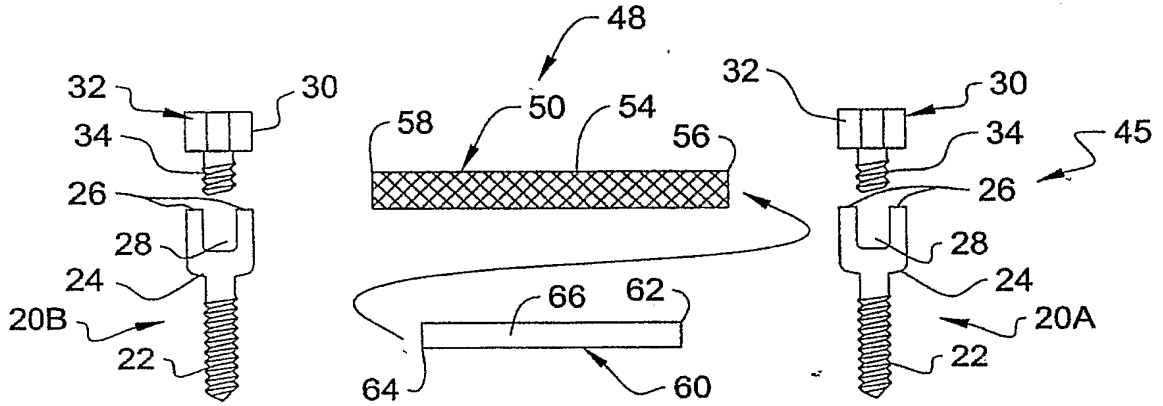


Fig. 1

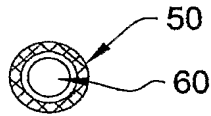


Fig. 3

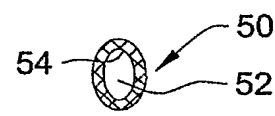


Fig. 2

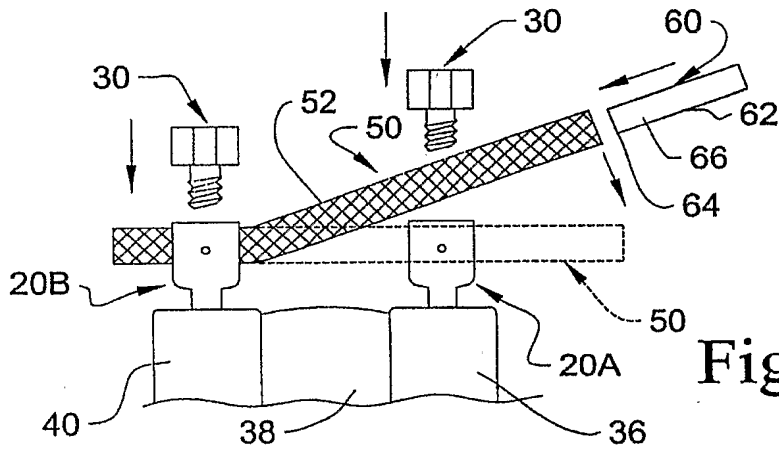


Fig. 4

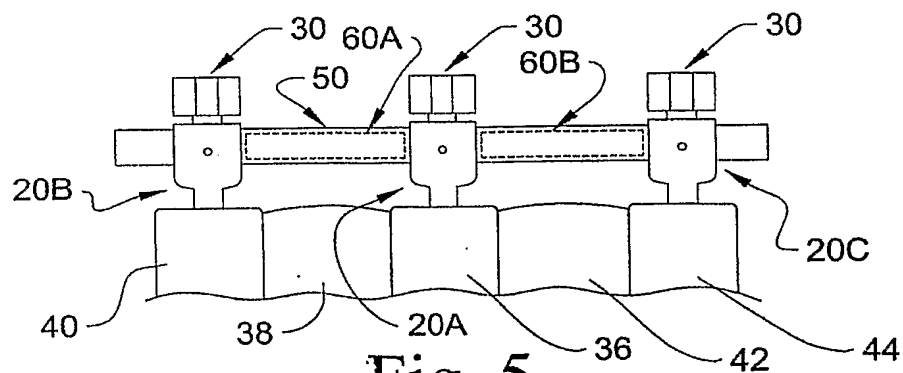


Fig. 5



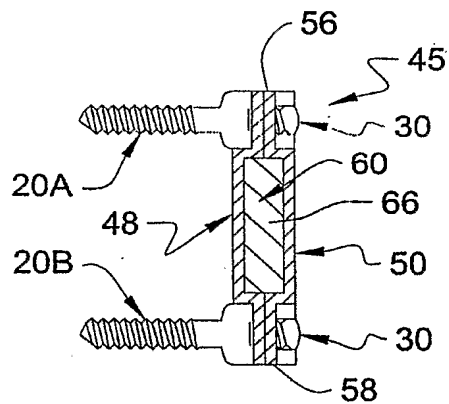


Fig. 6

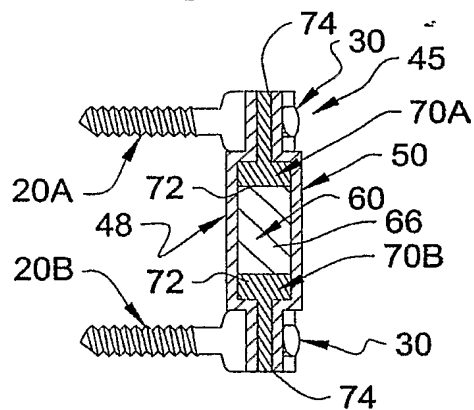


Fig. 7

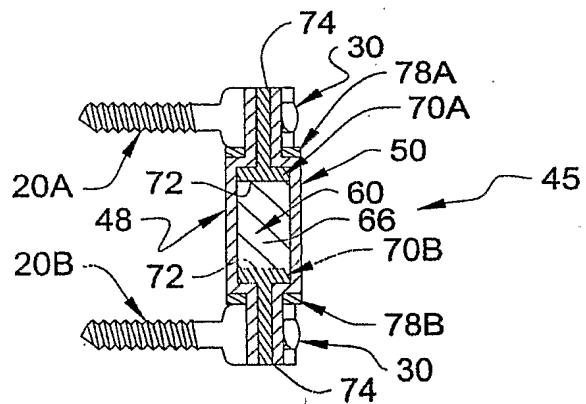


Fig. 8

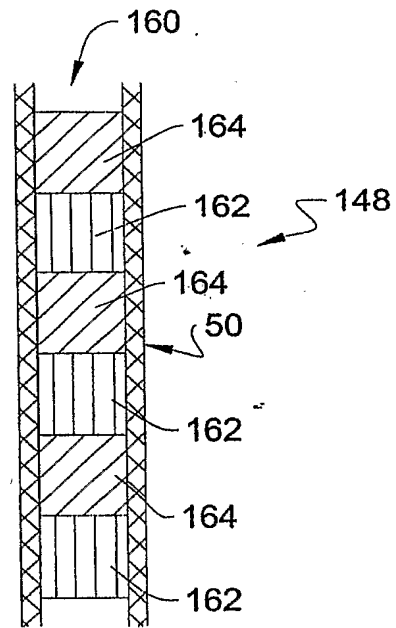


Fig. 9

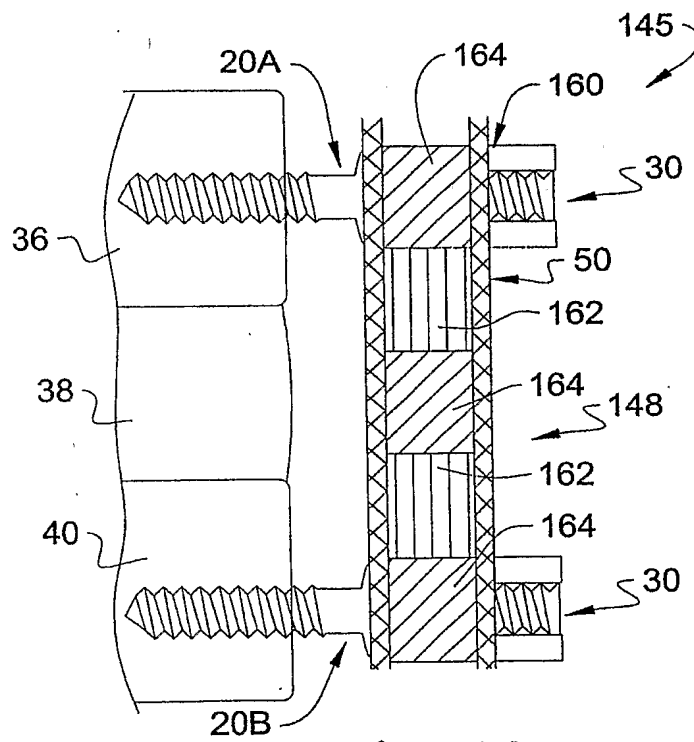


Fig. 10

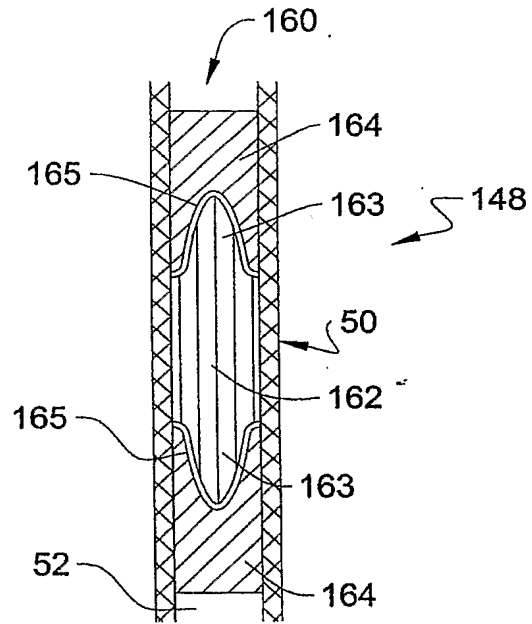


Fig. 11

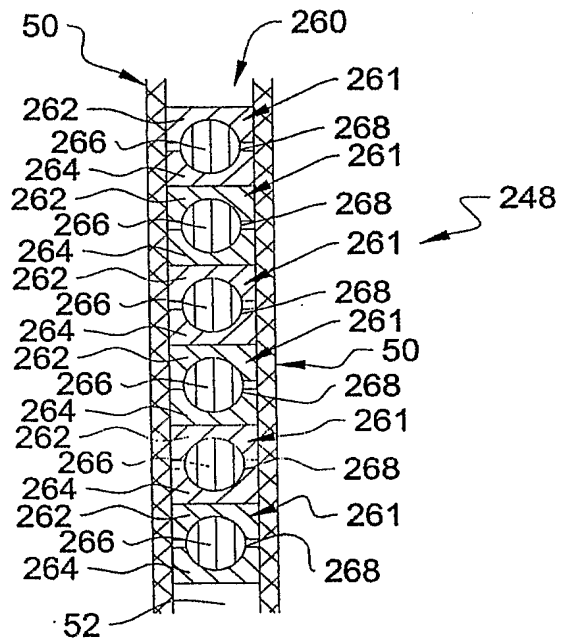


Fig. 12

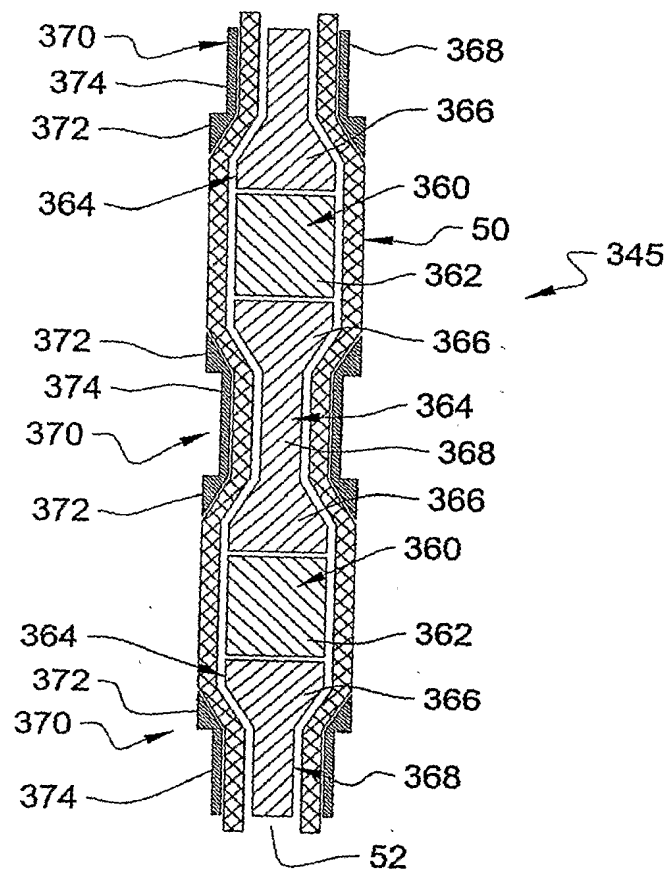


Fig. 13

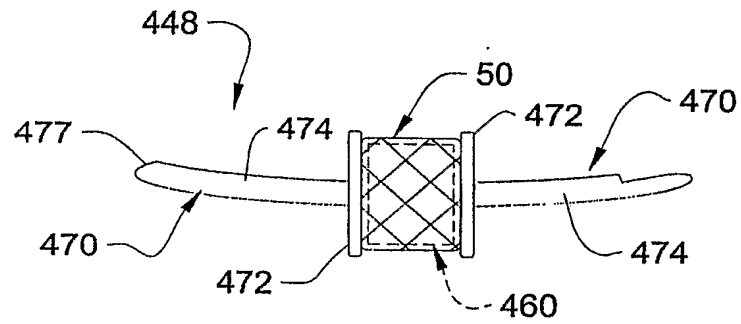


Fig. 14

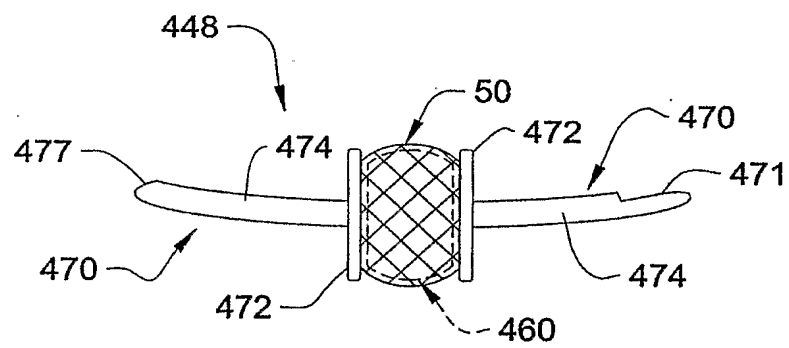


Fig. 15

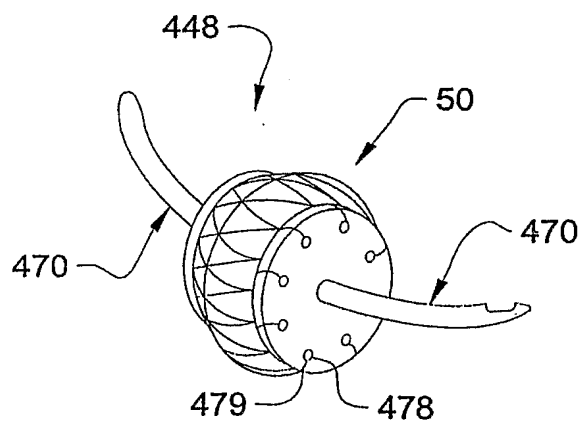


Fig. 16

# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/US2005/020228

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 A61B17/70

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A61B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 540 688 A (NAVAS ET AL) 30 July 1996 (1996-07-30) column 5, line 16 - line 34; figure 9	1-5, 13-17
A	WO 2004/024011 A (SPINEVISION; PETIT, DOMINIQUE) 25 March 2004 (2004-03-25) figures	1-41, 50-53
A	FR 2 726 995 A (EUROS SA) 24 May 1996 (1996-05-24) figure 6	1-41, 50-53
A	GB 2 382 304 A (DILIP KUMAR * SENGUPTA) 28 May 2003 (2003-05-28) the whole document	1-41, 50-53

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

### \* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

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Date of the actual completion of the international search

20 October 2005

Date of mailing of the international search report

02/11/2005

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Held, G

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/US2005/020228

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WO 2004024011	A	25-03-2004	AU	2003296319 A1	30-04-2004
			EP	1536735 A1	08-06-2005
			FR	2844180 A1	12-03-2004
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GB 2382304	A	28-05-2003	NONE		